Instruction Manual

CON 6/TDS 6

Hand-held Conductivity/TDS Meter

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68X243618

Rev.2 01/04

CE

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Preface

This manual serves to explain the use of the Conductivity and TDS handheld meters. The models covered are the CON 6 and TDS 6.

This manual functions in two ways: first as a step by step guide to help you operate the meter; second, it serves as a handy reference guide.

This manual is written to cover as many anticipated applications of the Conductivity and TDS handheld meters as possible. If there are doubts in the use of the Conductivity and TDS handheld meters, please do not hesitate to contact the nearest Eutech Instruments/ Oakton Instruments Authorized Distributor.

Eutech Instruments/ Oakton Instruments will not accept any responsibility for damage or malfunction to the meter caused by improper use of the instrument.

The information presented in this manual is subjected to change without notice as improvements are made, and does not represent a commitment on the part of Eutech Instruments Pte Ltd/ Oakton Instruments.

TABLE OF CONTENTS

1 INTRODUCTION

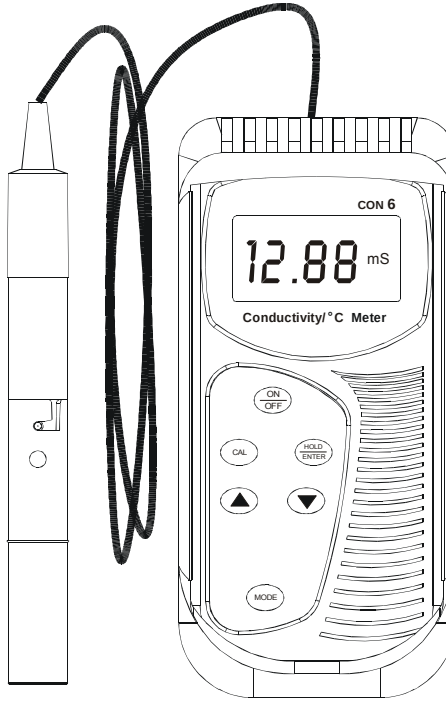
Thank you for purchasing CON 6/TDS 6 Conductivity/TDS meter. These economy microprocessor-based handheld meters deliver up to ±0.5% full-scale accuracy. It has a large custom LCD (Liquid Crystal Display) for clear and easy reading.

CON 6 measures Conductivity (µS/mS) and Temperature (°C) while the TDS 6 measures Total Dissolved Solids (TDS) and Temperature (°C). This sturdy meter measures up to 5 different ranges with auto-ranging capability that switches to appropriate measuring range automatically.

Your meter includes a conductivity electrode (cell constant K = 1.0) with built-in temperature sensor (Order Code: EC-CONSEN91B/ 35606-55), a rubber boot, 4 alkaline “AAA” batteries, instruction manual and warranty card.

Please read this manual thoroughly before operating your meter.

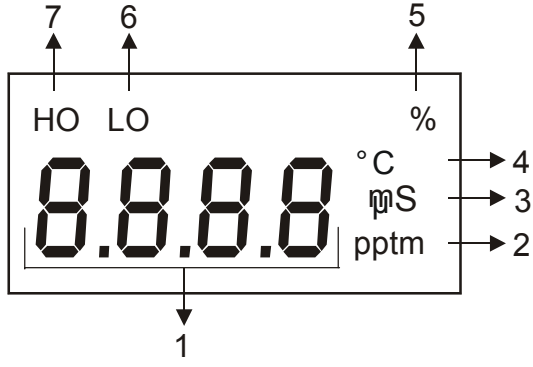
To order other accessories and buffer standard solutions, please refer to the Accessories Section for more information.


CON 6
12.88 mS
Conductivity/°C Meter
ON OFF
CAL
HOLD ENTER
MODE

2 DISPLAY & KEYPAD FUNCTIONS

2.1 Display

The meter has a large custom LCD that consists of 4-digit segments and operation annunciators for uS/mS (or ppm/ppt for TDS 6 meter) and °C (Temperature). Other annunciators include "HO" (when the HOLD function is activated) and "LO" (low battery condition). See Figure below.



LCD and Customized Annunciators for CON 6/TDS 6 meter

1. Primary display
2. Parts Per Million (ppm) or Parts Per Thousand (ppt) indicator - available for TDS 6 meter only.
3. milli-Siemens/cm (mS) or micro-Siemens/cm (µS) indicator - available for CON 6 meter only.
4. Temperature indicator
5. Percentage indicator for Temperature Coefficient.
6. Low battery indicator.
7. Hold (freezed) reading indicator.

2.2 Keypad

The CON 6 / TDS 6 meter has 6 keys on its splash-proof keypad; ON/OFF, HOLD/ENTER, CAL, MODE, ▲ and ▼ keys. Some buttons have several functions depending on its mode of operation.

	• Powers on and shuts off the meter. Takes you directly into measurement mode when meter is switched on.
	• Enters into calibration mode for Conductivity/TDS and Temperature. • To abort calibration or setup mode without confirming any set value.
	HOLD: Freezes the measured reading. To activate, press HOLD key while in measurement mode. To release, press HOLD key again. ENTER: Press to confirm values in calibration mode, and to confirm selections in SETUP mode.
 	• In Calibration Mode: Press to scroll through calibration values. • In Setup Mode: Press to scroll through the setup sub-group programs. • Press ▲ key during conductivity measurement mode to activate manual ranging function. Each key press will move up higher conductivity range.
	• Selects measurement mode for conductivity/TDS and Temperature. • When pressed together with ON/OFF key, it will take you into the SETUP mode. This allows you to customize meter preferences such as selecting electrode's cell constant, normalization temperature, temperature coefficient factor, TDS factor (for TDS 6), automatic (only CON 6) or manual calibration, single-point or multi-point calibrations, and to reset meter to factory default.

3 PREPARATION

3.1 Inserting & Removing Rubber Boot

(Rubber Boot sold separately)

1) To remove meter from rubber boot, push out from the bottom edges of meter until it is completely out of boot. Ensure that the cables of Conductivity electrode or temperature probe are not connected.

2) To insert meter into rubber boot, slide in from the top of meter before pushing the bottom edges of meter down to set it into position. Lift up the stand at the back of meter for bench top applications if necessary.

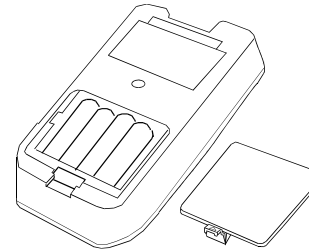
3.2 Inserting the Batteries

The battery compartment is found at the back of instrument as shown. To open the battery compartment:

1) Push in the direction of arrow and lift up the cover.

2) Note the polarity of battery before inserting into position.

3) After replacement, place cover back and press down until it locks tight.



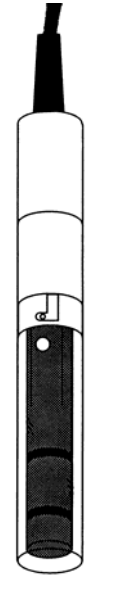
3.3 Battery Replacement

A “LO” annunciator in the LCD alerts you when battery power is running low. See Figure below. Replace with the same type as recommended by the manufacturer.

"LO" Battery Condition

Caution: Power off the meter when changing battery.

3.4 Conductivity Electrode Information



The CON 6/TDS 6 hand-held meter is supplied with a conductivity/TDS electrode with a BNC connector. This conductivity/TDS electrode (Order Part Number: EC-CONSEN91B/ 35606-55) comes with Stainless Steel rings, cell constant of K = 1.0, and a built-in temperature sensor for Automatic Temperature Compensation (ATC). Its specially designed Ultem-body housing has good chemical resistant properties. It provides fast temperature response and reduces air entrapment, which makes it easy to obtain accurate, stable readings.

The probe materials used which have good chemical durability include:

1. Polyetherimide (Ultem) – protective probe guard
2. Polybutylterphalate (Valox) – sensor housing
3. Stainless Steel (SS 304) – 2 steel bands

Proper use of probe is essential to ensure that the optimum measurement is taken in a short time.

The removable protective plastic probe guard is meant for simple periodic maintenance and it must be kept intact during measurement and calibration.

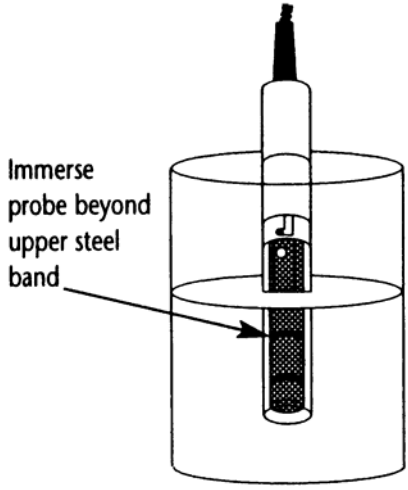
Always immerse the probe beyond upper steel band.

NOTE:

1) DO NOT remove the protective probe guard during measurement and calibration as it may affect your readings.

2) We recommend that you do not submerge the probe above the protective guard. You can submerge the cable for brief periods of time, but not continuously.

See *Section 7 – "Probe Care and Maintenance*" for more information.



3.5 Connecting the Probe to Meter

1) To connect electrode into meter, align the connector slots with the posts of meter's socket and rotate connector clockwise until it locks.

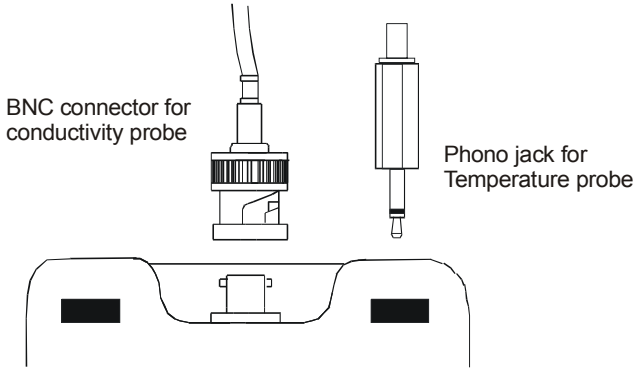
2) To remove, simply rotate the connector in anti-clockwise direction until it unlocks, and slide the connector off the socket.

3) Insert the mini phono jack of temperature sensor into the socket on the meter as shown below.

4) Unplug the phono jack when not in use or when you want to measure Conductivity or TDS without any temperature compensation (Manual Temperature Compensation, see Section 5.2).

CAUTION: Do not pull or force on the probe cord or the probe wires might disconnect.

NOTE: Keep connectors clean. Do not touch connector with soiled hands.

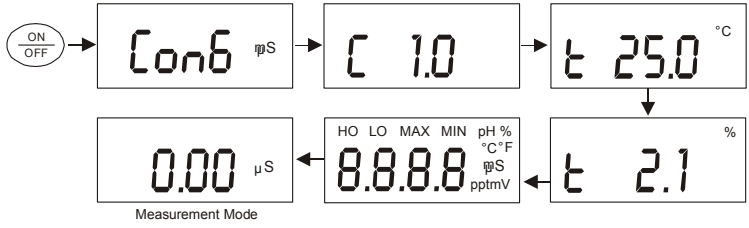


Connection for Conductivity & Temperature Probes

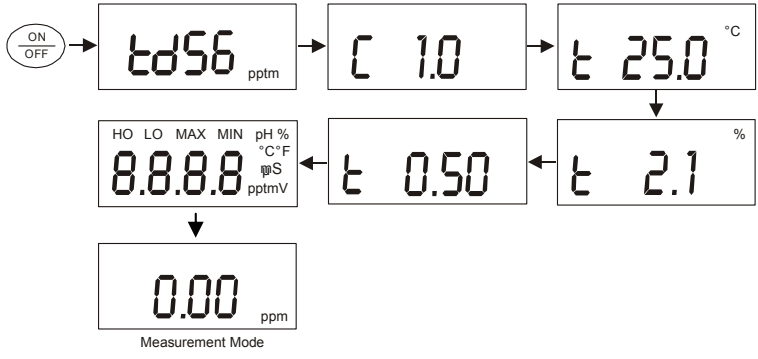
3.6 Switching the Meter On

When switching the meter on, it will go through a series of display, showing the various setup parameters.

For CON 6



For tdS 6



Press **ON/OFF** key to power up your meter.

1) The first screen shows [**Con 6**] (or [**tdS 6**]) which is the meter's name.

2) Second screen shows [**C 1.0]** which is the conductivity cell constant, k. You can select different cell constant of 0.1, 1.0 or 10.0. Refer to Section on Advance Setup. Default value is k=1.0.

3) Third screen shows [**t 25.0 °C**] which is the Normalization Temperature. You can set Normalization Temperature at either 25 °C or 20 °C. Refer to Section on Advance Setup. Default value is 25 °C.

4) Fourth screen shows [**t 2.1%**] which is the Temperature Coefficient. You can customise the meter with different Temperature Coefficient value from 0.0 to 3.0 %/°C from the Advance Setup mode. Default value is 2.1 %/°C.

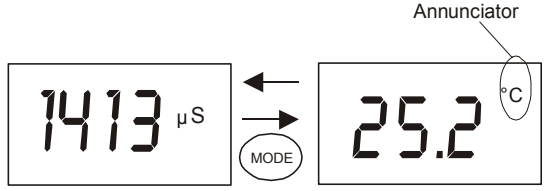
5) All LCD segments will light up for 2 seconds, and change into measurement mode.

6) You are now ready for conductivity measurement.

3.7 Change Conductivity/ TDS ⇔Temperature Measurement Mode

To switch between Conductivity/ TDS measurement mode and Temperature measurement mode, simply press the **MODE** key.

The customized annunciator helps indicate the measurement parameter you are in.



4 CALIBRATION

4.1 Important Information on Meter Calibration

Your meter has five measuring ranges. You can calibrate one point in each of the measuring ranges (up to five points). If you are measuring values in more than one range, make sure to calibrate each of the ranges you are measuring.

The following table lists the corresponding conductivity and TDS ranges. You should calibrate each range using a solution that falls between the values in the "recommended calibration solution range" column

Conductivity Range	Recommended Calibration Solution Range
0.00 → 20.00 µS	6.00 to 17.00 µS
0.0 → 200.0 µS	60.0 to 170.0 µS
0 → 2000 µS	600 to 1700 µS
0.00 → 20.00 mS	6.00 to 17.00 mS
0.0 → 200.0 mS	60.0 to 170.0 mS

TDS Range	Recommended Calibration Solution Range
0.00 → 10.00 ppm	3.00 to 8.50 ppm
10.0 → 100.0 ppm	30.0 to 85.0 ppm
100 → 1000 ppm	300 to 850 ppn
1.00 → 10.00 ppt	3.00 to 8.50 ppt
10.0 → 200 ppt	30.0 to 170 ppt

When you recalibrate your meter, old calibrations are replaced on a range basis. For example, if you previously calibrated your conductivity meter at 1413 µS in the 0 to 2000 µS range and you recalibrate at 1500 µS (also in the 0 to 2000 µS range), the meter will replace the old calibration data (1413 µS) in that range. The meter will retain all calibration data in other ranges.

To completely recalibrate your meter, or when you use a replacement probe, it is best to clear all calibration data. To erase all the old conductivity or TDS calibration data completely, see *Section 6.8 – Restore Factory Default* Values.

4.2 Preparing the Meter for Calibration

Before starting calibration, make sure you are in the correct measurement mode.

For best results, select a standard value close to the sample value you are measuring. Alternatively use a calibration solution value that is approximately 2/3 the full-scale value of the measurement range you plan to use. For example, in the 0 to 2000 µS conductivity range, use a 1413 µS solution for calibration.

Calibrate to all measurement ranges to ensure the highest accuracy throughout all measurement range. Note that CON 6/ TDS 6 will not accept calibration values less than 40 µS/cm (20 ppm). All new calibration values will automatically override existing data.

If you are measuring in solutions with Conductivity lower than 100 µS/cm or TDS lower than 50 ppm, calibrate the meter at least once a week to get good accuracy. If you are measuring in the mid ranges and you wash the probe in deionized water and store it dry, calibrate the meter once a month. If you take measurements at extreme temperatures, calibrate at least once a week.

Ensure that you use new Conductivity standard solutions or sachets during calibration. Do not reuse standard solutions as it may be contaminated and affect the calibration and accuracy of measurements. Use fresh calibration solution each time you calibrate your meter. Store solutions in a dry and cool environment if possible.

Always rinse the probe with either deionized water or rinse solution before and after each calibration/sample measurement to avoid cross-contamination. For details please refer to *Section 7 - Probe Care and Maintenance*.

NOTE: These meters are factory set to a temperature coefficient of 2.1% per °C. For most applications this will provide good results.
To set the temperature coefficient to different value, see Section 6.5 – Temperature Coefficient.
Also, see Addendum 3 - Calculating Temperature Coefficient to determine the appropriate temperature coefficient for your solution.

> *NOTE: The factory default value for normalization temperature is 25 °C. If you need to normalize to a value other than 25 °C, see* Section 6.6 – Normalization Temperature*.*

4.3 Selection of Automatic or Manual Calibration

This meter is capable of performing either automatic (only CON 6) or manual calibration.

In the automatic calibration mode, the meter (only CON 6) automatically detects and verifies the appropriate known calibration standards solutions being calibrated before accepting these particular calibration standards as one of its calibration values in a specific measurement range. This automatic calibration mode frees you from cumbersome calibration procedure.

The known calibration standards used for automatic calibration are:

Meter	Normalisation Temperature	Calibration Standards (Range)
CON 6	25 °C	1. 84 µS (for 0 – 200 µS/cm) 2. 1413 µS (for 0 – 2000 µS/cm) 3. 12.88 mS (for 0.00 – 20.00 mS/cm) 4. 111.8 mS (for 0.0 – 200.0 mS/cm)
	20 °C	1. 76 µS (for 0 – 200 µS/cm) 2. 1278 µS (for 0 – 2000 µS/cm) 3. 11.67 mS (for 0.00 – 20.00 mS/cm) 4. 102.1 mS (for 0.0 – 200.0 mS/cm)

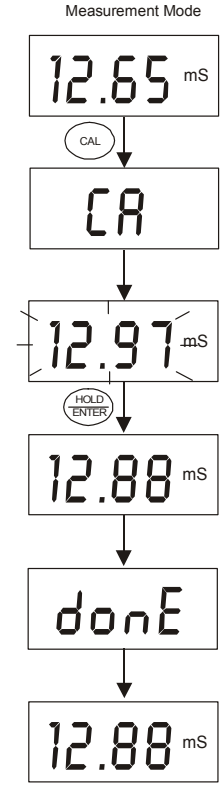
Table 1: Conductivity Calibration Standards for Auto calibrations

In the manual calibration, non-standard calibration values can be used for calibration. You can manually input the appropriate values as your desired calibration standards in each specific range. This is useful when you have a customized calibration standard specifically unique for your application.

To select Automatic or Manual Calibration settings, refer to *Section 6.3 – Automatic Calibration* for more information.

4.4 Automatic Calibration (Conductivity)

In the Automatic Calibration mode, the meter is capable of accepting either single-point or up to 4 points for multi-point calibration with maximum of 1 point per specific measurement range. For the known calibration standard values refer to *Table 1 in Section 4.3*.



1) If necessary, press **MODE** key to select conductivity mode.

2) Rinse the probe thoroughly with de-ionized water or a rinse solution, then rinse with a small amount of calibration standard.

NOTE: For Automatic Calibration you must use one of the calibration standards listed in Table 1.

3) Dip the probe into the calibration standard. Immerse the probe tip beyond the upper steel band (*see Figure in Section 3.4*). Stir the probe gently to create a homogeneous sample. Allow time for the reading to stabilize.

4) Press **CAL** key to enter conductivity calibration mode. The [**CA**] indicator will appear for 1.5 seconds, and a value will appear flashing.

NOTE: To exit calibration without confirmation, press CAL key again to go back to measurement mode.

5) Wait for the value to stabilize and press **ENTER** key. The calibration standard value will appear for 3 seconds. If the calibration is successfully performed, a [**donE**] will be displayed for about 3 seconds, and the meter returns to measurement mode.

6) To perform the next point calibration in the multi-point calibration, repeat step 1-5 again until all points have been calibrated if necessary.

IMPORTANT NOTES:

1. *Meter allows a tolerance range of ±40% of its calibration standard. An error message "**Err 1**" will be displayed for 3 seconds if you attempt to calibrate with a solution whose value is outside the tolerance range.*
   For instance: For 1413 µS conductivity calibration standard, 40% tolerance is from 848 µS to 1978 µS.
2. *If the temperature (t °C) of the conductivity calibration solution is below 0 °C or above 50 °C (0°C < t °C > 50 °C), an error message "**Err 2**" will be displayed when performing the auto calibration, and meter will return to measurement mode.*
3. *All new calibration data will over-ride existing stored calibration data for each measuring range calibrated.*
4. *It is important to use new conductivity calibration standards.*
5. *Low conductivity standard solution (less than 20 µS /cm) cannot be available easily. Such low conductivity standard will be contaminated as soon as it is exposed to the air therefore exercise caution during calibration in the first measurement range (0.00 to 20.0 µS /cm).*

4.5 Manual Calibration (Conductivity or TDS)

In Manual Calibration mode, you can use customized conductivity calibration standards (specific to your own application) and calibrate the meter. The following example shows calibration sequence to 12.00 mS conductivity calibration standard.

Procedure is similar for CON 6 and TDS 6 meters.

1) If necessary, press **MODE** key to select conductivity mode.

2) Rinse the probe thoroughly with de-ionized water or a rinse solution, then rinse with a small amount of calibration standard.

3) Dip the probe into the calibration standard. Immerse the probe tip beyond the upper steel band (*see Figure in Section 3.4*). Stir the probe gently to create a homogeneous sample. Allow time for the reading to stabilize.

4) Press **CAL** key to enter conductivity calibration mode. The [**CA**] indicator will appear for 1.5 seconds, and a value will appear flashing.

NOTE: To exit calibration without confirmation, press CAL key again to go back to measurement mode.

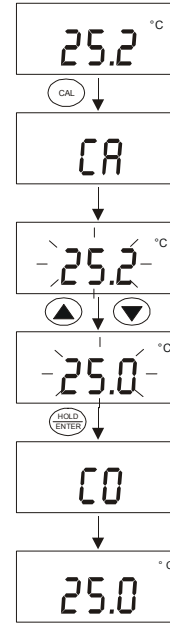
5) Wait for the value to stabilize and press ▲ or ▼ key and adjust the value to the calibration standard used.

6) Press the **ENTER** key. The [**CO**] indicator will appear for 1.5 seconds, and the calibration is successfully performed. The meter returns to measurement mode.

7) To perform the next point calibration in the multi-point calibration for next range, repeat step 1-6 again until all points have been calibrated if necessary.

4.6 Temperature Calibration

The Conductivity electrode (Refer to Accessories section for order number) has a built-in temperature sensor for ATC. The temperature sensor is factory calibrated to the meter. Calibrate your sensor only if you suspect temperature errors that may have occurred over a long period of time or if you have a replacement probe.



1) Make sure that the phono jack (for temperature measurement) is properly connected to the meter. *See Figure in Section 3.5*.

2) Switch on the meter and if necessary, press **MODE** key to select temperature measurement mode. *See Section 3.7*.

3) Press **CAL** key to start temperature calibration process.

4) Dip the probe into a solution with known temperature (for example, a temperature bath). Allow time for the temperature to stabilize.

5) Wait for the value to stabilize and press ▲ or ▼ key and adjust the value to the solution temperature.

6) Press the ENTER key. The [**CO**] indicator will appear for 1.5 seconds, and the reading will stop flashing. The temperature calibration is successfully performed. The meter returns to measurement mode.

NOTE: To exit calibration without confirmation, press CAL key again to go back to measurement mode.

NOTE: You can offset the temperature reading up to ±5 °C from the original (default) reading.

5 MEASUREMENT

The CON 6/TDS 6 meter is capable of taking measurements with automatic or manual temperature compensation.

5.1 With Automatic Temperature Compensation (ATC)

For ATC, make sure the phono jack of the probe (*see Figure in Section 3.5*) is securely inserted.

The conductivity/TDS reading displayed will be compensated for according to the normalization temperature (20 °C or 25 °C) selected. *See Section 6.6 – Normalization Temperature.*

5.2 Without ATC (Manual Temperature Compensation)

For manual temperature compensation, simply unplug the probe's phono jack (not BNC) from the meter.

To use manual temperature compensation, you need to enter the temperature value of your process into the meter. This is the value at which the reading will manually temperature compensates. You can select any temperature between 0 and 50 °C (32 to 122 °F). Default value is 25 °C.

1) Make sure that the phono jack (for temperature measurement) is disconnected from the meter. *See Figure in Section 3.5*.

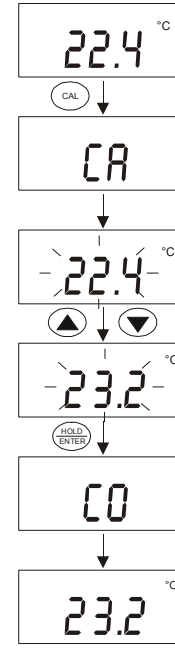
2) Switch on the meter and if necessary, press **MODE** key to select temperature measurement mode. *See Section 3.7*.

3) Press **CAL** key to start temperature calibration process.

4) The "**CA**" will appear momentarily and a temperature value will start flashing.

5) Check the temperature of your sample using an accurate thermometer. Wait for the value to stabilize and press ▲ or ▼ key and adjust the value to the reference thermometer used.

6) Press the **ENTER** key. The [**CO**] indicator will appear for 1.5 seconds, and the reading will stop flashing. The temperature calibration is successfully performed. The meter returns to measurement mode.



5.3 Taking Measurements

To take readings:

1) Rinse the probe with de-ionized or distilled water before use to remove any impurities adhering to the probe body. Shake or air dry. To avoid contamination or dilution of your sample, rinse probe with a small volume of your sample liquid.

2) Press **ON** to switch on meter.

3) Dip the probe into the sample.

4) Allow time for the reading to stabilize. Note the reading on the display.

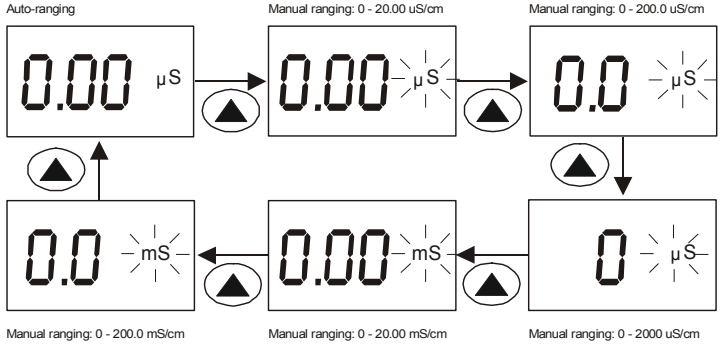
> *NOTE: When dipping the probe into the sample, take care to ensure that the liquid level is above its upper steel band. Stir the probe gently in the sample to create a homogenous sample. See Figure in Section 3.4.*

5.4 Using Manual Ranging Function

By default your meter has auto-ranging ability and would automatically selects the range in which your readings appear.

However, you may also manually select a specific range you want to measure. This is possible by simply pressing ▲ key successively for each measurement range. The five ranges are:

Conductivity Range (CON 6)	**TDS Range (TDS 6) (if TDS factor is 0.5)**
0 – 20.00 µS/cm	0 – 10.00 ppm
0 – 200.0 µS/cm	0 – 100.0 ppm
0 – 2000 µS/cm	0 – 1000 ppm
0 – 20.00 mS/cm	0 – 10.00 ppt
0 – 200.0 mS/cm	0 – 100 ppt



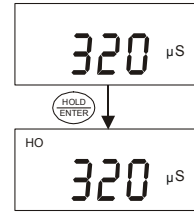
NOTE:

*If the value of the solution you are measuring is higher than the range selected [**Or**] will appear on the primary display. Press RANGE until the correct range is selected.*

The meter resets to the Auto-ranging function once it is turned off. You will have reset the manual ranging function each time you turn the meter off.

5.5 HOLD Function

This feature lets you freeze the display for a delayed observation. **HOLD** can be used any time in measurement mode.



1) To hold a measurement, press the **HOLD** key while in measurement mode. [**HO**] will appear on the display.

2) To release the held value, press the **HOLD** again. Continue to take measurements.

NOTE:

This meter shuts off automatically after 20 minutes of nonuse.

If the meter is shut off either automatically or manually, the HOLD value will be lost.

6 ADVANCED SETUP FUNCTIONS

6.1 Advanced Setup Overview

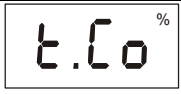
The advanced setup mode lets you customize your meter's preferences and defaults. To enter advanced setup mode:

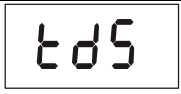
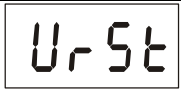
1) Make sure that the meter is switched-off.

2) Press **ON** and **MODE** key simultaneously, holding both keys for 2 seconds. First release **ON** key first before releasing the MODE key.

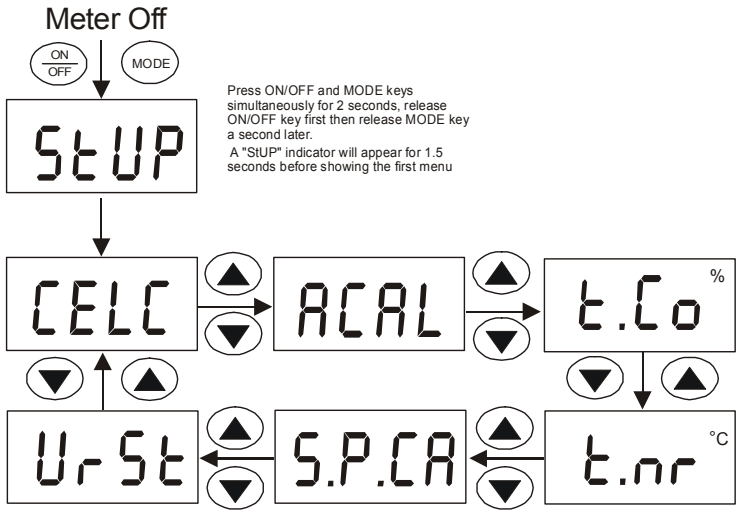
3) [**StUP**] indicator will appear momentarily and [**CELC**] will appear next.

4) Overviews of CON 6 and TDS 6's Setup Menu as follows.

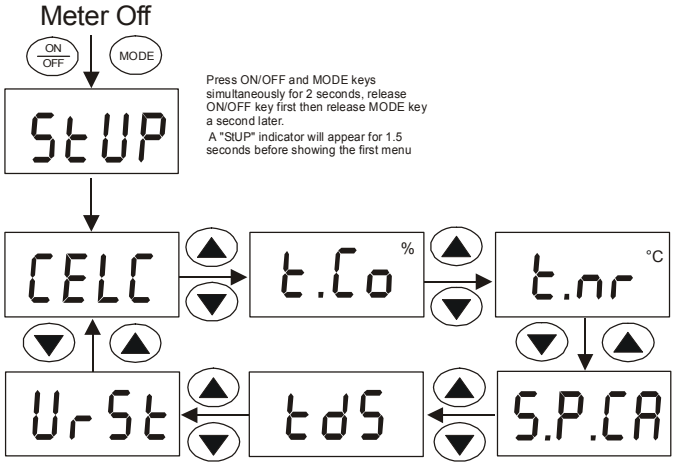
	Enter Setup Page.
	Select Cell Constant. Choice of k = 0.1, 1.0, and 10.0. Default value is 1.0.
	Select Automatic Calibration. "Yes" for auto calibration and "no" for manual calibration. Default value is "Yes". ***(Available in CON 6 meter only)***
	Adjust Temperature Coefficient value from 0.0 to 3.0 %/°C. Default value is 2.1 %/°C.

	Select Normalization Temperature. Choice of either 20 °C or 25 °C. Default value is 25 °C.
	Adjust TDS factor from 0.4 to 1.0. Default value is 0.5. ***(Available in TDS 6 meter only)***
	Select Single Point Calibration. Choice of "Yes" or "No". Default value is "Yes".
	User re-set to factory defaults. Choice of "Yes" or "No". Default value is "no".

Overview of Advanced Setup



Overview of CON 6 Setup Menu



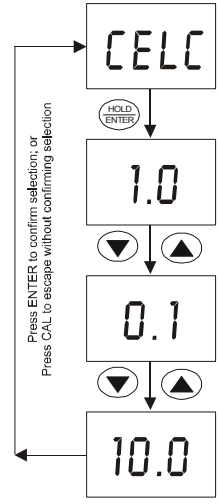
Overview of TDS 6 Setup Menu

6.2 Select Cell Constant

This meter lets you select a cell constant of K = 1.0, 10, or 0.1.

- Use a cell of K = 1.0 for midrange measurements
- Use a cell of K = 10 for high range measurements (above 20 mS or 10 ppt).
- Use a cell of K = 0.1 for low range measurements (below 20 µS or 10 ppm).

The cell included with your meter has a cell constant of K = 1.0.



1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [**CELC**] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select either “1.0”, “0.1” or “10.0”. Ensure the cell constant selected correspond with the conductivity electrode you are using.

4) Press **ENTER** key to select. The meter will take you back to the menu, [**CELC**].

5) Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.

6.3 Automatic Calibration (for CON 6)

The automatic calibration allows you to quickly calibrate the meter to any of the four widely used conductivity calibration standards. For a list of calibration standards refer to *Table 1 in Section 4.3*.

In the manual calibration mode, you can use you own customized conductivity calibration standard to calibrate this meter.

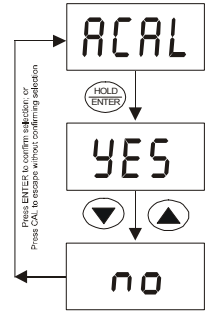
1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [**ACAL**] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select either [**Yes**] or [**no**].

4) Press [ENTER] key to select. The meter will take you back to the menu, [**ACAL**].

5) Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.



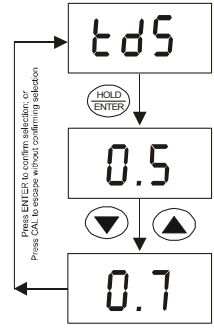
6.4 Setting the TDS Factor (for TDS 6)

The concentration of salts dissolved in solution increases the conductivity of that solution. This relationship varies from salt to salt and is roughly linear over a given range for a given salt. The TDS conversion factor is the number used by the meter to convert from conductivity to TDS.

To calculate the TDS conversion factor refers to *Addendum 2 – Calculating TDS Conversion Factor*.

You can also look up at various Chemical reference books for TDS factor for various types of salt.

You can set the TDS conversion factor between 0.4 and 1.0; meter default is 0.5.



1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [**tdS**] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select a value between 0.4 to 1.0.

4) Press **ENTER** key to select. The meter will take you back to the menu, [**tdS**].

5) Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.

6.5 Temperature Coefficient

The temperature coefficient is the amount of change in conductivity per degree of temperature; it is expressed in percent per °C. Entering the exact temperature coefficient of your solution lets you accurately compensate temperature for almost any solution. You can adjust 0.0 to 3.0 % per °C.

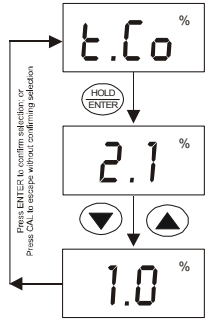
Meter default is 2.1% per °C.

6) Enter the advanced setup as described in Section 6.1.

7) Press ▲ or ▼ key until [**t.Co %**] appears on the LCD. Press **ENTER** key.

8) Press ▲ or ▼ key to select a value between 0.0 to 3.0.

9) Press **ENTER** key to select. The meter will take you back to the menu, [**t.Co %**].



Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.

6.6 Normalization Temperature

You can set the meter to normalize its conductivity measurements to a standard temperature of either 25 °C or 20 °C.

The default value is 25 °C.

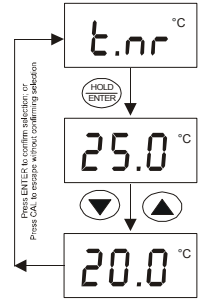
1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [**t.nr °C**] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select either [**25.0 °C**] or [**20.0 °C**].

4) Press **ENTER** key to select. The meter will take you back to the menu, [**t.nr °C**].

5) Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.



6.7 Single-Point Calibration

Single-point calibration refers to calibrating one conductivity value and uses it for the entire 5 conductivity ranges.

By selecting [**no**] to single-point calibration, you can perform calibration for each conductivity range.

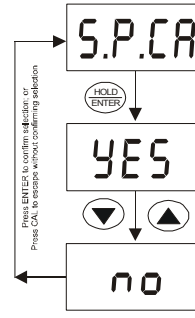
1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [S.P.CA] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select either [**Yes**] or **no**].

4) Press **ENTER** key to select. The meter will take you back to the menu, [**S.P.CA**].

5) Press ▲ or ▼ key to move to the next menu or press **CAL** to exit to measurement mode.



6.8 Restore Factory Default Values

This function allows you to reset all parameters to factory default settings. This clears all calibration data and any other setup functions you might have changed.

IMPORTANT: Once activated the meter's settings and calibration data will be erased and always exercise caution as meter reset is not reversible.

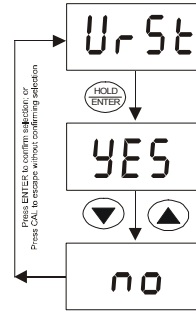
1) Enter the advanced setup as described in Section 6.1.

2) Press ▲ or ▼ key until [UrSt] appears on the LCD. Press **ENTER** key.

3) Press ▲ or ▼ key to select either [**Yes**] or [**no**].

4) Press **ENTER** key to select.

5) The meter will go back to measurement mode after the switch-on initialization as shown in figure on Section 3.6. .



7 PROBE CARE AND MAINTENANCE

Keep the conductivity probe clean. Rinse the probe twice, and gently swirl it while you take readings. For best accuracy, soak a dry probe for at least 5 to 10 minutes or longer before calibration. Rinse the probe with deionized or tap water before storing. Never scratch the bands with a hard substance. Do not strike the probe against any hard surface.

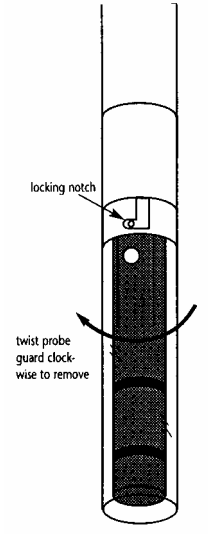
Do not immerse the probe in oily solutions. Clean the electrode thoroughly by stirring it in a mild detergent bath or isopropyl alcohol. Wipe the probe with a soft tissue paper. Rinse thoroughly in tap water and then in deionized water. Recalibrate the meter after cleaning the probe.

The conductivity probe (Order Part No. EC-CONSEN91B/ 35606-55) which is included with your meter features a removable probe guard to make cleaning easy.

To remove probe guard:

1) Grip yellow probe guard and twist clockwise. The locking notch will release.

2) Slide probe guard off end of probe.



NOTE: Remember to re-attach the probe guard prior to taking readings. Failure to do so could result in erroneous readings.

8 TROUBLE-SHOOTING GUIDE

Problem	Cause	Solution
Power on but no display	a) Batteries not in place b) Batteries not in correct polarity (+ and – position). c) Weak batteries	a) Check that batteries are in place and making good contact. b) Re-insert batteries with correct polarity. c) Replace batteries.
Unstable readings	a) Air bubbles in probe. b) Dirty probe. c) Probe not deep enough in sample. d) External noise pickup or induction caused by nearby electric motor. e) Broken probe.	a) Tap probe to remove bubbles. b) Clean the probe and re-calibrate. c) Make sure sample entirely covers the probe sensors. d) Move or switch off interfering motor. e) Replace probe.
Slow response	a) Dirty / Oily probe.	a) Clean probe. See “Probe Care & Maintenance”.

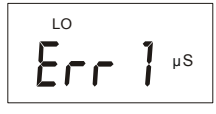
9 ERROR MESSAGES

LCD Display	Indicates	Cause	Solution
"LO" indicator appears.	Low battery level.	Need new batteries or battery connection is bad.	Clean battery contacts. Replace batteries with fresh ones, noting polarity.
Err 1	Conductivity calibration error	Calibration point is outside the ±40% window in the auto-calibration.	Check the value of the conductivity calibration solution. Switch to manual calibration mode and calibrate again. If message persists, return unit*.
Err. 2	Temperature calibration error.	Auto calibration is performed outside the temperature range (0 – 50 °C).	Check the temperature and make sure that it is within the acceptable range. If message persists, return unit*.
Err. 3	Conductivity calibration error.	Calibration point is within 10% of the measurement range in the manual calibration mode.	Check the value of the conductivity calibration solution. If message persists, return unit*.

* See *Sections on "Warranty" and "Return of Items"*.

If an error message appears, switching off the meter and switching it on again may eliminate the error message. Refer to diagram on right.

If error persists, or the meter shows incorrect values, return the meter.



For a complete diagram of the display see page 3.

10 SPECIFICATIONS

SPECIFICATIONS	DESCRIPTIONS	CON 6	TDS 6
Conductivity Range	0 to 20.00, 200.0, 2000 µS/cm; 0 to 20.00, 200.0 mS/cm	•	
Resolution	0.01, 0.1, 1 µS/cm: 0.01, 0.1 ,S/cm		
Accuracy	±1% F.S.		
TDS Range	0 to 10.00, 10.0 to 100.0, 100 to 1000 ppm; 1.00 to 10.00, 10.00 to 100.0, Up to 200 ppt depending on the TDS factor setting.		•
Resolution	0.01, 0.1, 1 ppm; 0.01, 0.1 ppt	•	•
Accuracy	±1% F.S.	•	•
Temperature Range	-10.0 to 110.0 °C	•	•
Resolution/Accuracy	0.1 °C / ± 0.5 for °C	•	•
Cell Constant	0.1, 1.0, 10.0 (selectable)	•	•
Temperature Compensation	Automatic / Manual (from 0 to 50 °C)	•	•
Temperature Coefficient	0.0 to 3.0% / °C	•	•
Normalization Temperature	20.0 °C and 25.0 °C (selectable)	•	•
Conductivity to TDS Conversion factor	0.4 to 1.0		•
Number of calibration points	5: Maximum 1 per range	•	•

Auto- & Manual-ranging		•	•
HOLD Function		•	•
Auto Power off	20 minutes after last key operation	•	•
Inputs	BNC for conductivity and phono jack for temperature	•	•
Display	Single Custom LCD	•	•
Power Requirements	4 'AAA' Batteries	•	•
Battery Life	> 100 hours	•	•
Dimension / Weight	Meter: 14 x 7 x 3.5 cm; 200 g	•	•

11 ACCESSORIES

Replacement Meter and Meter accessories

Item	Eutech Instruments Ordering Code No.	Oakton Instruments Ordering Code No.
CON 6 portable conductivity meter complete with conductivity probe of k=1.0 (EC-CONSEN91B/ 35606-55).	EC-CON603k	35606-10
CON 6 portable TDS meter complete with conductivity probe of k=1.0 (EC-CONSEN91B/ 35606-55).	EC-TDS603K	35606-15
3 ring SS, Ultem body Electrode with ATC & BNC plug (for CON 6), cell constant = 1.0, x110 mm, 1m cable length	EC-CONSEN91B	35606-55
Carrying Kit with empty bottles	EC-ECODRY-KIT	35632-97
Electrode Storage Solution	EC-RE-005	00653-04
Electrode Cleaning Solution	EC-DPC-BT	00653-06

Calibration Solutions

1,413 µS KCl Calibration Solution in 480-ml leak-proof bottle (1 pint)	EC-CON-1413BT	00653-18
12.88 mS KCl Calibration Solution in 480-ml leak-proof bottle (1 pint)	EC-CON-1288BT	00606-10
2,764 µS KCl Calibration Solution in 480-ml leak-proof bottle (1 pint)	EC-CON-2764BT	00653-20
10 µS conductivity standard sachet, 20 ml x 20 pcs	EC-CON-10BS	35653-09
447 µS Conductivity Sachets (20 units x 20 ml per box)	EC-CON-447BS	35653-10
1,413 µS Conductivity Sachets(20 units x 20 ml per box)	EC-CON-1413BS	35653-11
2,764 µS Conductivity Sachets(20 units x 20 ml per box)	EC-CON-2764BS	35653-12
15,000 µS Conductivity Sachets(20 units x 20 ml per box)	EC-CON-15000BS	35653-13

12 CONDUCTIVITY THEORY

Conductance is a quantity associated with the ability of primarily aqueous solutions to carry an electrical current, I, between two metallic electrodes when a voltage E is connected to them. Though water itself is a rather poor conductor of electricity, the presence of ions in the water increases its conductance considerably, the current being carried by the migration of the dissolved ions. This is a clear distinction from the conduction of current through metal, which results from electron transport.

The conductance of a solution is proportional to and a good, though non-specific indicator of the concentration of ionic species present, as well as their charge and mobility. It is intuitive that higher concentrations of ions in a liquid will conduct more current. Conductance derives from Ohms law, E = IR, and is defined as the reciprocal of the electrical resistance of a solution.

$$C = 1 / R$$

where C is conductance (siemens)
R is resistance (ohms)

One can combine Ohms law with the definition of conductance, and the resulting relationship is:

$$C = I / E$$

where I is current (amps)
E is potential (volts)

In practice, conductivity measurements involve determining the current through a small portion of solution between two parallel electrode plates when an AC voltage is applied. Conductivity values are related to the conductance (and thus the resistance) of a solution by the physical dimensions --- area and length --- or the cell constant of the measuring electrode. If the dimensions of the electrodes are such that the area of the parallel plates is very large, it is reasonable that more ions can reside between the plates, and more current can be measured. The physical distance between the plates is also critical, as it effects the strength of the electric field between the plates. If the plates are close and the electric field is strong, ions will reach the plates more quickly than if the plates are far apart and the electric field is weak. By using cells with defined plate

areas and separation distances, it is possible to standardize or specify conductance measurements.

Thus derives the term specific conductance or conductivity.

The relationship between conductance and specific conductivity is:

Specific Conductivity, S.C. = (Conductance) (cell constant, k)
= siemens * cm/cm^2
= siemens/cm

where C is the conductance (siemens)
k is the cell constant, length/area or cm/cm^2

Since the basic unit of electrical resistance is the ohm, and conductance is the reciprocal of resistance, the basic unit of conductance was originally designated a “mho” – ohm spelled backwards – however, this term has been replace by the term “siemen”. Conductivity measurements are reported as Siemens/cm, since the value is measured between opposite faces of a cell of a known cubic configuration. With most aqueous solutions, conductivity quantities are most frequently measured in microSiemens per cm (µS/cm) or milliSiemens per cm (mS/cm).

The salinity value which ranges from 2 to 42 is a measure of all salts, not just sodium chloride. This scale was originally devised for seawater, and is based on seawater at 15 °C having a conductivity equivalent to that of a potassium chloride solution of a known concentration. This solution (0.44 molal) is defined as having a salinity of 35 ppt.

The total dissolved solids scale approximate the ppm TDS in surface waters by multiplying the conductivity of a sample by a factor, 0.66.

Some users prefer the use of resistivity units to describe their water, particularly where high purity water is involved. The unit most often used to describe resistivity is megohm-cm, which are simply the reciprocal of conductivity (µS/cm). The chart below shows the relationship between these units.

Conductivity, µS/cm	Resistivity, megohm-cm
0.056	18
0.1	10
1.0	1.0
2.5	0.4
10.0	0.1

Conductivity and Temperature

Conductivity in aqueous solutions reflects the concentration, mobility, and charge of the ions in solution. The conductivity of a solution will increase with increasing temperature, as many phenomena influencing conductivity such as solution viscosity are affected by temperature.

The relationship between conductivity and temperature is predictable and usually expressed as relative % change per degree centigrade. This temperature coefficient (% change per degree) depends on the composition of the solution being measured. However, for most medium range salt concentration in water, 2% per degree works well. Extremely pure water exhibits a temperature coefficient of 5.2%, and concentrated salt solutions about 1.5%.

Since temperature affects the conductivity measurement so profoundly, the usual practice is to reference the conductivity to some standard temperature. This is typical 25 °C, but the CON 6 and TDS 6 meters permit the choice of 20 °C or 25 °C in the advance setup menu.

Both meters permit you to enter the temperature coefficient which best suits your sample and use an ATC probe to automatically temperature compensate back to the chosen reference temperature.

13 ADDENDUM 1: CALIBRATION TIPS

You only need **one** calibration for measurement throughout the entire range of the meter. If a range was not calibrated, the meter automatically detects the closest range calibrated and uses that calibration information. However, only the ranges that were calibrated have maximum accuracy.

If you are measuring in ranges near to or greater than 20 mS (10 ppt), or near to or lower than 100 µS (50 ppm), calibrate the meter at least once a week to get specified ±1% F.S. accuracy.

If you are measuring in the mid-ranges and you washed the probe in deionized water and stored it dry, calibrate the meter at least once a month.

Wet the probe for 10 minutes before calibrating or taking readings to saturate the probe surface and minimize drift. If you make measurements at extreme temperatures, calibrate the meter at least once a week.

You should only use the conductivity / TDS probe specified for these meters. These probes have a built-in temperature sensor. If you use a different probe without a temperature sensor, you must measure the solution temperature separately and manually enter the solution temperature (see manual temperature compensation section 5.2)

14 ADDENDUM 2: CALCULATING TDS CONVERSION FACTOR

You can calibrate your meter using TDS calibration standard solutions. The calibration standard only needs to give the TDS value at a standard temperature such as 25 °C. To determine the conductivity-to-TDS conversion factor use the following formula:

Factor = Actual TDS ÷ Actual Conductivity @ 25 °C

Definitions:

- Actual TDS: Value from the solution bottle label or as a standard you make using high purity water and precisely weighed salts.
- Actual Conductivity: Value measured using a properly calibrated Conductivity/Temperature meter.

Both the Actual TDS and the Actual Conductivity values must be in the same magnitude of units. For example, if the TDS value is in ppm the conductivity value must be in µS; if the TDS value is in ppt the conductivity value must be in mS.

Check your factor by multiplying the conductivity reading by the factor in the above formula. The result should be in TDS value.

15 ADDENDUM 3: CALCULATING TEMPERATURE COEFFICIENTS

To determine the temperature coefficient of your sample solution use this formula:

$$tc = 100 \times \frac{C_{T2} - C_{T1}}{C_{T1}(T_2 - 25) - C_{T2}(T_1 - 25)}$$

Where:

tc = Temperature coefficient

25 = 25 °C

$\mathbf{C_{T1}}$ = Conductivity at Temp 1

$\mathbf{C_{T2}}$ = Conductivity at Temp 2

$\mathbf{T_1}$ = Temp 1

$\mathbf{T_2}$ = Temp 2

NOTE: A controlled temperature water bath is ideal for this procedure.

1. Immerse the probe into a sample of your solution and adjust the temperature coefficient to 0% (that is, no compensation) by following instructions as described in *Section 6.5 – Temperature* Coefficient.
2. Wait for 5 minutes. Note $\mathbf{T_1}$ and $\mathbf{C_{T1}}$ (conductivity at $\mathbf{T_1}$).
3. Condition the sample solution and probe to a temperature ($\mathbf{T_2}$) that is about 5 °C to 10 °C different from $\mathbf{T_1}$, and note the conductivity reading $\mathbf{C_{T2}}$.

NOTE: Record your results for future reference. Ideally $\mathbf{T_1}$ and $\mathbf{T_2}$ should bracket your measurement temperature, and should not different by more than 5 °C.

4. Calculate the temperature coefficient of your solution according to the formula shown above.
5. Enter the temperature coefficient you calculated into the meter. *Refer to Section 6.5 – Temperature Coefficient.*

The calculated temperature coefficient will not be applied to all the meter readings.

16 WARRANTY

This meter is supplied with a warranty against significant deviations in material and workmanship for a period of **THREE** years from date of purchase whereas probe with a **SIX**-month warranty.

If repair or adjustment is necessary and has not been the result of abuse or misuse within the designated period, please return – freight pre-paid – and correction will be made without charge. Eutech Instruments/ Oakton Instruments will determine if the product problem is due to deviations or customer misuse.

Out of warranty products will be repaired on a charged basis.

Exclusions

The warranty on your instrument shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Unauthorized modification or misuse
- Operation outside of the environment specifications of the products

17 RETURN OF ITEMS

Authorization must be obtained from our Customer Service Department or authorized distributor before returning items for any reason. A “Return Goods Authorization” (RGA) form is available through our authorized distributor. Please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Eutech Instruments/ Oakton Instruments will not be responsible for damage resulting from careless or insufficient packing. A restocking charge will be made on all unauthorized returns.

NOTE: Eutech Instruments Pte Ltd/ Oakton Instruments reserves the right to make improvements in design, construction, and appearance of products without notice.

NOTES

For more information on Eutech Instruments/ Oakton Instruments' products, contact your nearest distributor or visit our website listed below:

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